

AD-A106 440

BLACK AND VEATCH KANSAS CITY MO

F/G 13/13

NATIONAL DAM SAFETY PROGRAM, JOHNSON COUNTY DAM A-1 (MO 20020),--ETC(U)

JUN 80 P R ZAMAN, E R BURTON, H L CALLAHAN

DACW43-80-C-0074

NL

UNCLASSIFIED

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AD
A106-440



END

DATE

FILED

11-8

DTIC

Location **Johnson County**

Location	Johnson County
Watershed	South Fork of Blackwater

Owner _____

Sato

MISSOURI SOIL CONSERVATION

Watershed **South Fork of Blackwater**
Located by **Nuel F. Edmonds**

Sub-watershed _____
Date 1/25 1963

Project: WPL 08-7

Site No. A-1
Pub. 46

Drilling Equipment

Project: WFI ----- WFZ -----
 9 Fill 11+50 E+00

[illegible]

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.
Other copies as directed by State Conservationist.

Sheet of Sheets

Form 903-533
Rev. Dec. 58

LOG OF TEST HOLES

Location	Johnson County,		State	Missouri
Watershed	South Fork of Blackwater		Sub-watershed	
Logged by	Nugl F. Edwards		Date	4/25 19 63
Project	WP 03-7492		Project	FP
Location of Holes	5+00		Location of Holes	5+00
Equipment	Pebble B-40		Equipment	
Site No.	A-1		Site No.	A-1
Pub. 46			Pub. 46	
Samples			Samples	

[illegible]

* Disturbed-undisturbed-rock core.
† Percent sample recovery.
‡ copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

Johnson County

Johnson County
South Fork of Blackwater

Owner _____

Sub-watershed _____

State

Missouri

Site No. A-1

Site No.

**Don't miss
Nucl F. Edmonds**

Date _____

Date 4/25 19 63 Protect: WPZ

43

Pub. 46.

Collected by _____
 Station _____
 Mobile B-40

Location of Holes

4+00 E+00

Location of Hole									
Hole No.	Station and Surface Elev.	Hole Depth		Unif. Soil Class. Symb.	Type Bit Used	Samples			
		From Ft.	To Ft.			Type	From Ft.	To Ft.	Rec. %
103	355.8	0	8	Silt, clayey, dark brown to reddish brown, slightly moist, firm, slightly plastic, alluvial soil (low) becomes very moist at 7'	CL	FA	2	1	6
				No water level Total Depth 8'					

* Disturbed, undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.
Other copies as directed by State Conservationist.

Sheet of Sheets

LOG OF TEST HOLES

7/27, Dec. 30

Location	Johnson County	Owner	State	Missouri
Watershed	South Fork of Blackwater	Sub-watershed	Site No.	A-1
Logged by	Muel F. Edwards	Date	Project: WFO-7 WP2	Pub. 45
Volume	Volume B-40	Location of Notes	9 Fill 12+30	

Hole No.	Station and Surface Elev.	Hole Depth		Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples					
		From ft.	To ft.				Type	From Ft.	To Ft.	Rec. %		
201	875.5	0	6	Clay, silty, yellowish brown mottled gray, slightly moist, stiff, moderately plastic, residual soil	CL	FA						
		6	10	Clay silty, reddish waxy, moist, stiff, plastic residuum	CL	FA						
				No water level Refusal at 10'								

* Disturbed undisturbed-rock core.
1. copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.
† Percent sample recovery.
Other copies as directed by State Conservationist.

LOG OF TEST HOLES

Form 823-533
Rev. Dec. 58

Location Johnson County State Missouri Site No. A-1
Watershed South Fork of Blackwater Sub watershed _____
Logged by Huel F. Edwards Date 4/25/63 Project: WP 08-7 Pub. 46
Drilling Equipment Mobile 1-10 Location of Holes Fill 5+70 83' R offset to Sta approx.

Hole No.	Station and Surface Elev.	Hole Depth		Description of Materials	Unit, Soil Class, Symb.	Type Bit Used	Samples			Rec. %
		From	To				No.	Type	From	
		ft.	ft.						ft.	
302	143.0	0	3	Gravel, clayey, 40% fine, silty, fill	FA					
		3	16	Silt, clayey, 20% coarse sand and small gravel, maximum size 1/4", dark brown, wet, soft, slightly plastic, alluvial	ML FA					
		16	18	Dark gray shale, dry, hardness 2-3						
				Water level 1' Total Depth 18'						

Sheet 1 of 1 Sheets

* Dist. bed undisturbed rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with sample.
Other copies as directed by State Conservationist.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

FILE
DESIGN

SCS-309
8-58

RESERVOIR SEDIMENTATION DESIGN SUMMARY

WATERSHED S. Fork of Blackwater SITE NO. A-1 STATE Missouri
LOCATION Johnson County DATE 1/25/53
DATA COMPUTED BY Nuel F. Edmonds TITLE Geologist

SEDIMENT SOURCES (AVERAGE ANNUAL)

TYPE OF EROSION		PRESENT CONDITIONS			FUTURE (AFTER CONS. TREATMENT)		
		ACRES	SOIL LOSS (TONS/AC)	TOTAL (TONS)	ACRES	SOIL LOSS (TONS/AC)	TOTAL (TONS)
SHEET EROSION	CULTIVATED LAND	563	10.18	5732	160	1.47	236
	IDLE LAND	21					
	PASTURE-RANGE	617	4.53	2796	1197	1.29	1539
	WOODLAND	340	1.95	663	184		255
	OTHER	59	1.95	115	59	1.95	115
TOTAL SHEET EROSION			DELIVERY RATE (%)		TONS DELIVERED	DELIVERY RATE (%)	TONS DELIVERED
			27	9306	2513	27	2145
CHANNEL EROSION	GULLY		95	766	723	95	138
	STREAMBANK						
	STREAMBED						
FLOODPLAIN SCOUR							
OTHER (ROADSIDE ETC.)			95	32	30	95	8
TOTALS					3271		717

AREA OF WATERSHED:
1600 ACRES
2.50 SQ. MI.

DEPOSITION

AVERAGE DRY WEIGHT OF UPLAND SOILS: 80 LBS/CU. FT.			AVERAGE ANNUAL SEDIMENT DELIVERED TO SITE FROM ALL SOURCES (TONS)		TRAP EFFICIENCY (%)	ANNUAL DEPOSITION (TONS)	DESIGN PERIOD (YRS)	PERIOD TOTAL DEPOSITION (TONS)
TEXTURE OF SEDIMENT			PRESENT	3271	95	3107	7	21,749
% CLAY	% SILT	% COARSE	FUTURE	717	95	681	43	29,283
30	50	20	DESIGN TOTALS					51,032

SEDIMENT STORAGE REQUIREMENTS

CONDITION OF SEDIMENT	% OF TOTAL	DEPOSITION (TONS)	VOLUME WEIGHT OF SEDIMENT		STORAGE REQUIRED		STORAGE ALLOCATION (ACRE FEET)		
			LBS/CU. FT.	TONS/AC. FT.	ACRE- FEET	WATERSHED INCHES	SEDIMENT POOL	RETARDING POOL	OTHER
SUBMERGED	90	45,929	55	1197	38.4	.29	38.4		---
AERATED	10	5,103	80	1742	3.0	.02	---	3.0	---
TOTALS		51,032			41.4	.31	38.4	3.0	---

Time = 100 yr.

UNITED STATES GOVERNMENT

Memorandum

TO : W. S. Culpepper, State Conservation Engineer, SCS, Columbia, Missouri

DATE: July 25, 1963

FROM : Ray S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

SUBJECT: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 1 sheet.
2. Consolidation Data, 1 test, 3 sheets.
3. Form SCS-355, Triaxial Shear Test Data, 2 sheets.
4. Form SCS-352, Compaction & Penetration Resistance Report, 2 sheets.
5. Form SCS-357, Summary - Slope Stability Analysis, 1 sheet.

DISCUSSION

FOUNDATION:

- A. Classification: The bedrock underlying this site consists of shale that contains a thin zone of limestone at about floodplain elevation. The soil mantling the bedrock is a moderately plastic CL. The CL mantle is quite uniform as indicated by the samples submitted. The gradation and plasticity varied within narrow limits. The CL mantle ranges in thickness from about 5 feet on the abutments to about 30 feet in the floodplain section.

Dispersion of the fraction finer than 0.005 mm is quite high.

- B. Blow Count and Density: Blow count in the saturated CL was in the range of 5 to 10 blows/foot except for a 5.5 foot zone from the 17 to 22.5 foot depth in Hole No. 4 (Station 7+00) where 2 blows/foot were recorded. The core submitted from Test Hole 5 is quite typical of most of the foundation based on a comparison of the natural moisture contents of samples submitted. Generally the density of the CL foundation alluvium can be expected to be greater than 1.52 (95 p.c.f.) except for the 5.5 foot zone of soft material logged in Test Hole 4.

The moisture content of the split spoon sample submitted from the soft zone was 32.6 percent compared to less than 28.5 percent for the other samples submitted. The computed density of the CL in the soft zone is 1.43 g/cc.

- C. Shear Strength: A shear test was made on the core sample. The test was made at natural moisture content and the following strength values were

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Ray S. Decker

Subj: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

obtained: The in-place strength is $c = 575$ p.s.f. as indicated by the unconfined compression test; the consolidated strength is $\phi = 16^\circ$, $c = 425$ p.s.f. as indicated by the consolidated, undrained triaxial test.

The test values are in the same range as those shown for blow count vs. shear strength for CL material in the "Guide Manual". The strength of the soft CL based on blow count and computed density is estimated to be in the range of $\phi = 10^\circ$, $c = 300$ p.s.f.

- D. Consolidation: A consolidation test on the core sample indicates that the alluvium is normally consolidated and that the consolidation potential of this material is about 3% under the proposed loading at floodplain elevation (856). The compressible stratum is judged to be about 23 feet thick, therefore the total consolidation in the foundation is expected to be about 0.66 foot.

Differential consolidation around the relatively deep channel section is not expected to be a problem since the compacted fill in this section will have about the same consolidation potential as the foundation.

- E. Permeability: The vertical permeability of the alluvium is expected to be in the range of 0.01 ft./day.

EMBANKMENT:

- A. Classification: The borrow materials submitted consist of residual soil over shale that is classed as a high plasticity CL and moderately plastic CL alluvium.
- B. Compacted Density: Standard compaction tests on the borrow samples resulted in compacted densities of 106.5 p.c.f. and 110.0 p.c.f.
- C. Shear Strength: A consolidated, undrained triaxial shear test was made on Sample 63W3885 to represent the majority of the borrow material. The test was made at 95% of Standard density at saturation. The shear values obtained were $\phi = 17.5^\circ$, $c = 750$ p.s.f.

SLOPE STABILITY:

Stability of the proposed $2\frac{1}{2}:1$ slopes was checked with a Swedish Circle Method of analysis. The analysis was made at the maximum section and the foundation was considered as stratified with a 6 foot stratum of soft CL ($\phi = 10^\circ$, $c = 300$ p.s.f.) immediately overlying the bedrock.

The factor of safety obtained against full drawdown on the $2\frac{1}{2}:1$ upstream slope with a 10 foot berm at elevation 863 was $F_s = 1.30$. The factor of safety obtained for

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Ray S. Decker

Subj: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

the $2\frac{1}{2}$:1 downstream slope without a drain was $F_s = 1.22$. By adding a 10 foot berm in the channel, the factor of safety increases from $F_s = 1.22$ to $F_s = 1.36$.

Trials No. 2A and 3 show the factors of safety for the dry slope condition immediately after construction assuming no foundation consolidation and an in-place shear strength of $\phi = 0$, $c = 575$ p.s.f. The F_s on the upstream slope for this condition is 1.27 for a deep arc failure.

RECOMMENDATIONS

- A. Cutoff Trench: We recommend a minimum depth of 6.0 feet for the cutoff trench between Stations 2+50 and 8+50. A trench depth greater than 6.0 feet may be required in the bottom of the channel depending on materials encountered. The cutoff trench should bottom on the limestone bedrock in the vicinity of Stations 2+50 and 8+50. On the right abutment above Station 2+50, the trench should bottom on shale. On the left abutment above Station 8+50, a minimum trench depth of 6.0 feet is suggested. We recommend that the trench bottom on the thin limestone stratum so that the limestone can be carefully examined for fractures, etc. in order to evaluate the permeability.

With the trench depths suggested, near positive cutoff is anticipated where the trench bottoms in CL or shale. The only uncertainty appears to be in the area of the limestone stratum on each side of the valley.

The trench should be backfilled with CL compacted to a minimum of 95% of Standard Proctor density.

The trench excavation may be used in the fill.

- B. Principal Spillway: Foundation conditions at the proposed location appear to be fairly uniform except for the channel bottom as shown by Test Hole 303 where the material is logged as soft ML. For this reason, it may be desirable to shift the conduit slightly so that the lower end of the conduit will be on the firm CL alluvium also.

✓ The estimated consolidation potential at the intersection of the $\frac{1}{2}$ of the dam and the principal spillway is estimated to be 0.66 foot. Based on this estimate, the horizontal strain at natural ground surface is expected to be in the range of 0.01 ft./ft.

- C. Drain: It appears that the only area where drainage might be necessary is at the base of each abutment where a thin limestone stratum is suspected. If the limestone proves to be in good condition and positive cutoff is obtained, drainage is not believed to be required. If, however, the limestone

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Ray S. Decker

Subj: Missouri WP-08, South Fork of Blackwater River, Site No. A-1

is permeable, drains should be installed to provide a safe outlet for seepage that will by-pass the cutoff trench. Any reasonably well graded sand and gravel could be used for the drain.

D. Embankment Design:

1. Placement of Materials: A homogeneous embankment of CL is recommended. The CL should be placed at a minimum of 95 percent of Standard Proctor density with placement moisture contents of near optimum to the wet side of optimum.

2. Slopes: The following slopes are recommended:

Upstream: $2\frac{1}{2}$:1 with a 10 foot berm at normal pool elevation and a 10 foot berm in the channel.

Downstream: $2\frac{1}{2}$:1 with a 10 foot berm in the channel. *Used 12' - for pipe Lengths*

The channel berms are believed to be necessary in view of the low factor of safety obtained on the downstream slope without the berm for the conditions assumed and also because soft ML material was logged below channel elevation in Test Hole 302.

3. Settlement: An overfill allowance of 1.0 foot is suggested to compensate for residual settlement within the fill and foundation.

Attachments

Prepared by:

Lorn P. Dunnigan
Lorn P. Dunnigan

Reviewed & Approved by:

R. B. Phillips
Roland B. Phillips

cc: W. S. Culpepper (2 copies)
H. J. Behrens, Milwaukee, Wis.

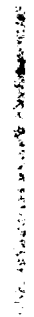
Form SCS-354
Rev. 3/59

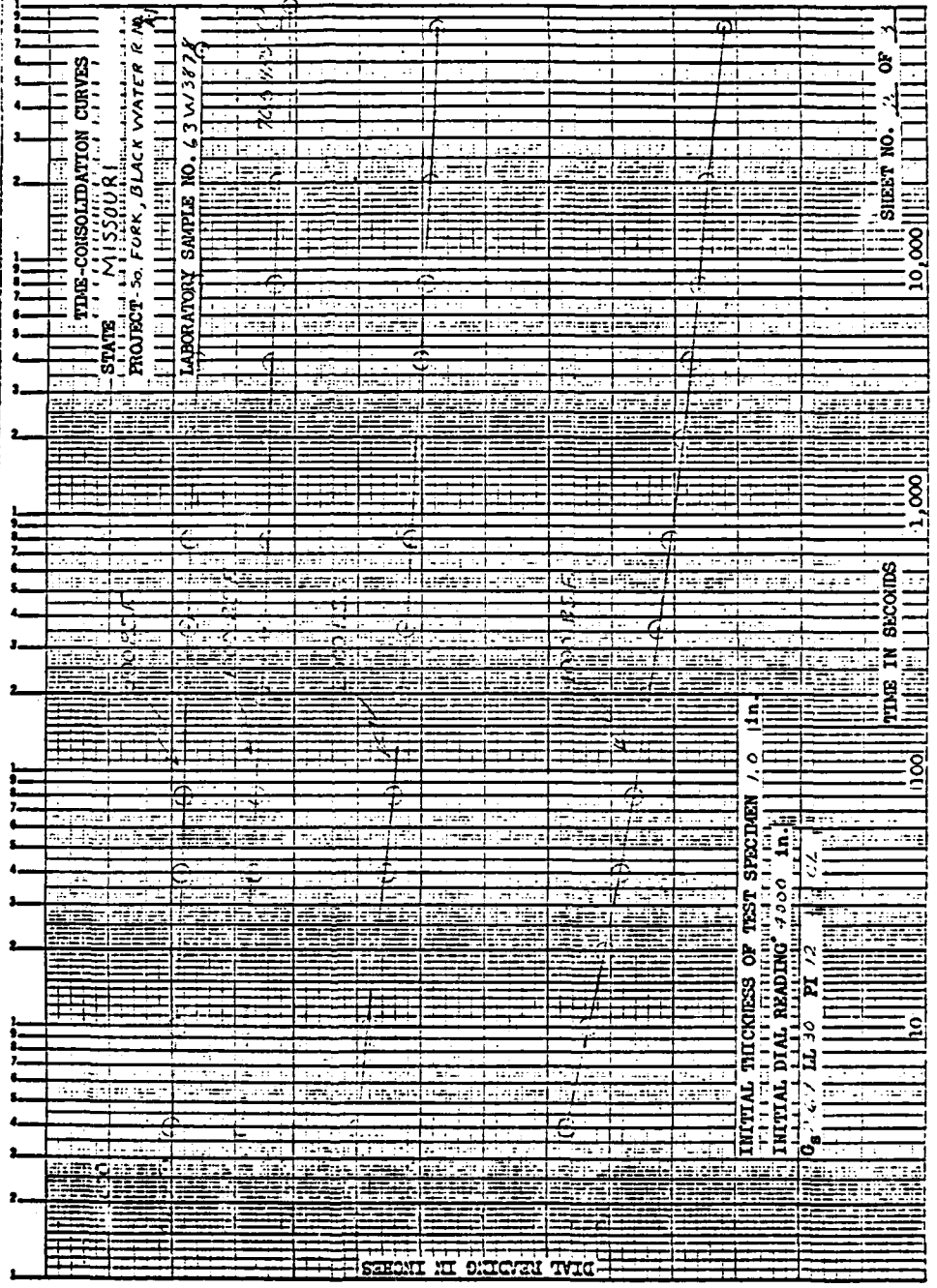
June 10, 1963

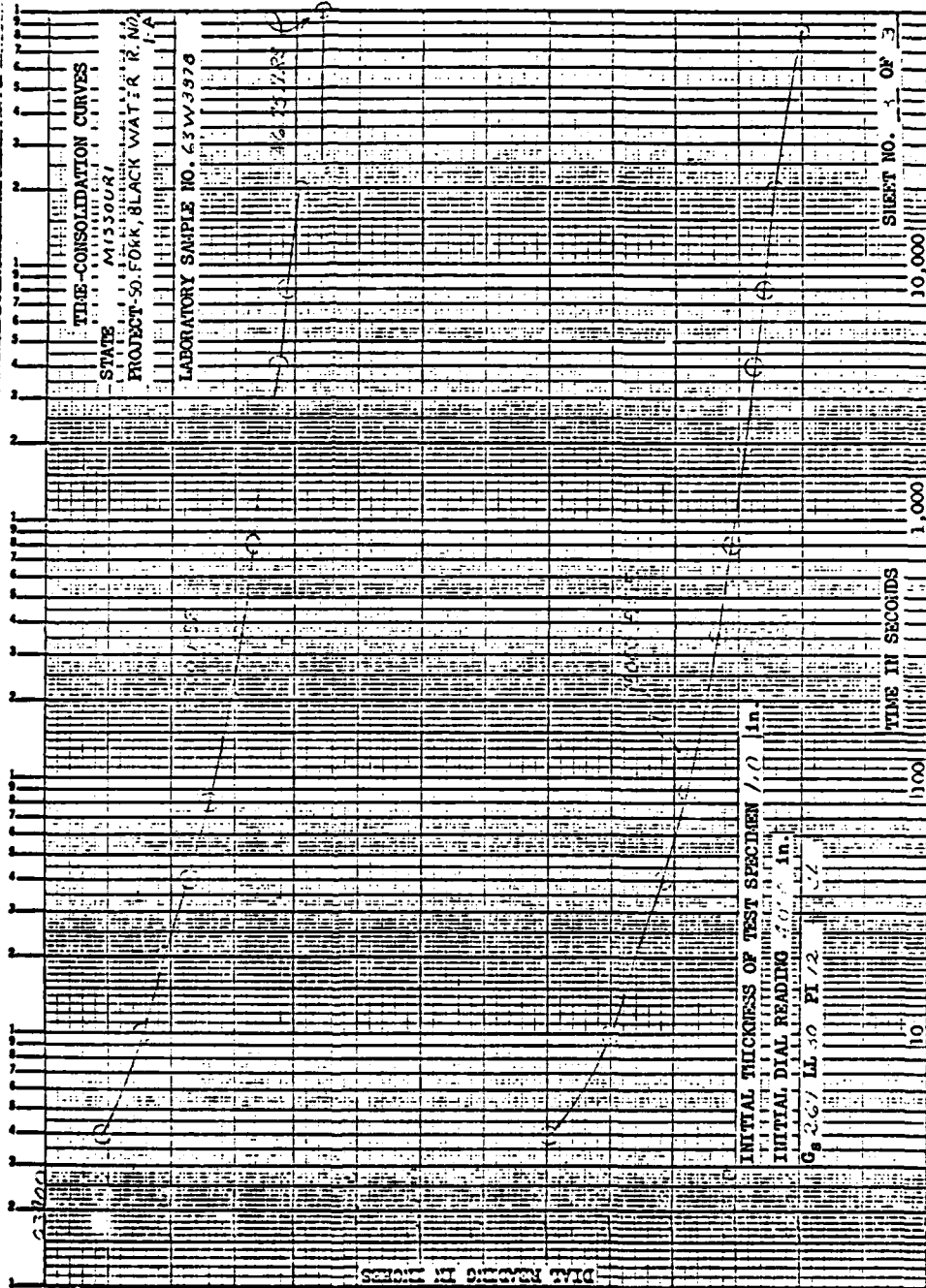
LABORATORY SAMPLE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION			DEPTH	FIELD CLASS- IFICATION	GRA			
							FINES			
							002	005	002	10
634		South Fork of Blackwater	Site No. A-1							
3877	301-1	Fill	5+70	Jar	14.5- 15.5'	CL	25	32	51	72
3878	301-2	Fill Alluvium	"	Core	19-21'	CL	20	26	41	61
3879	301-3	Fill	"	Jar	24.5-25.5'	CL	23	32	53	71
3880	4-1	Fill	7+00	Jar	9.5- 10.5'	CL	27	33	52	72
3881	4-2	Fill	"	Jar	14.5- 15.5'	CL	25	35	56	72
3882	4-3	Fill	"	Jar	19.5- 20.5'	CL	22	26	53	68
3883	4-4	Fill	"	Jar	24.5- 25.5'	CL	25	34	52	68
3884	101-1	Fill Residual soil over shale	5+00 to 5+50 L. B. S.	Jar	1-7'	CL	24	30	55	71
3885	102-1	Composite	7+00 to 5+00	L. B. S. Comp.	1-7'	CL	23	30	52	71
	103-1	Borrow	7+00 to 4+00	CL		CL				
		Alluvium	+ 1/3 500							

[illegible]

[illegible]





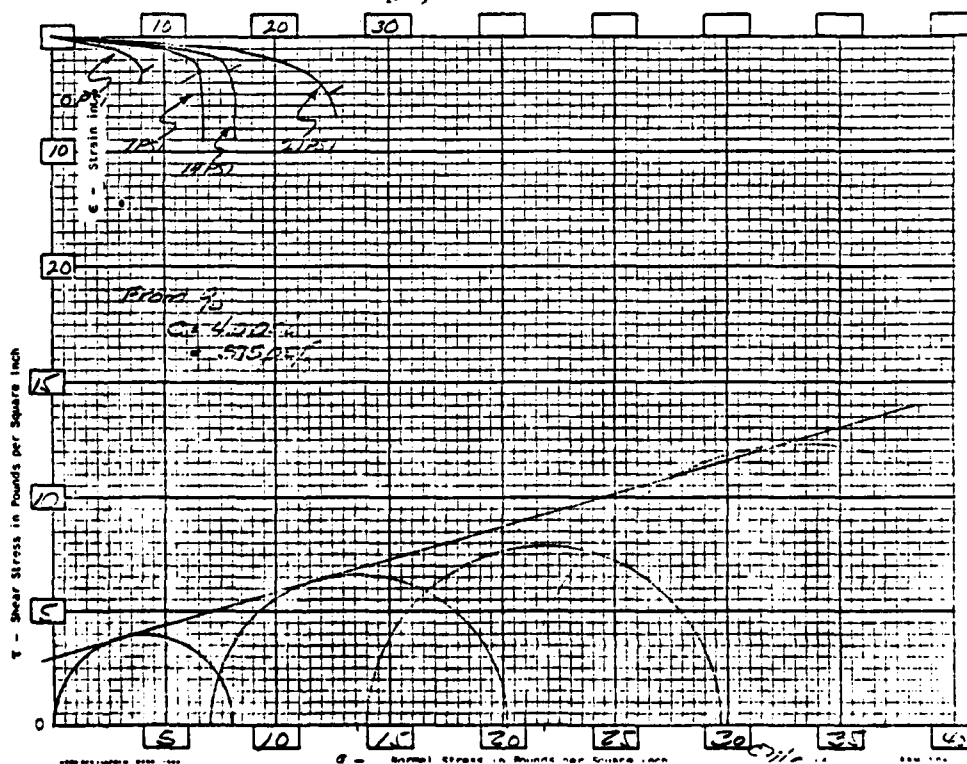


SC-355 (REV. 4/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

Sample Number 63W397BProject BLACKWATER RIVER #A-1Location MISSOURI

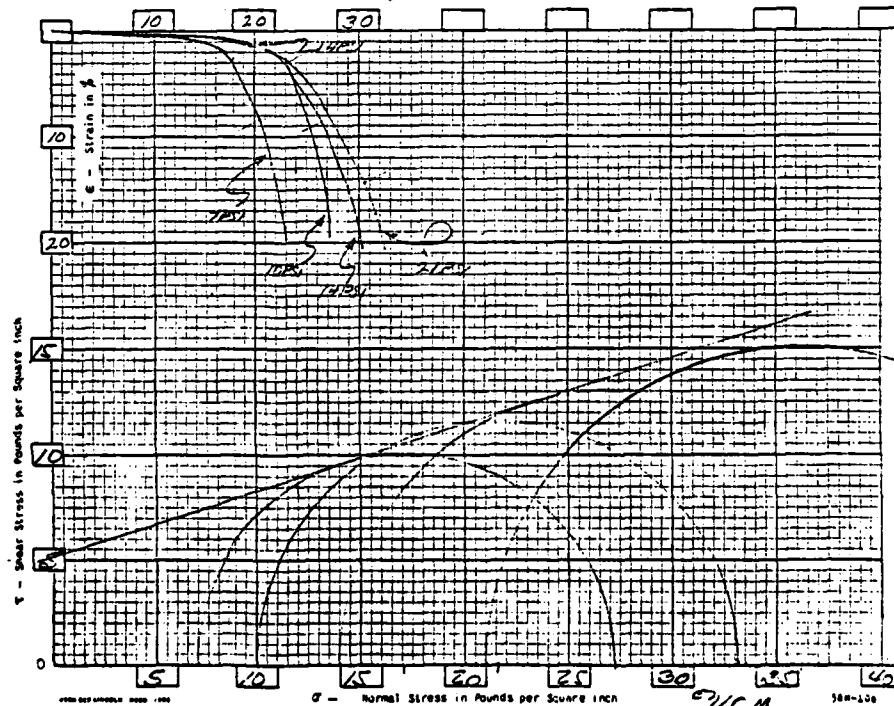
Moisture-Density Data				Specifications:							
Standard <input type="checkbox"/>	Max. γ _____ pcf			Specimen: Max. <input checked="" type="checkbox"/> Consolidated <input type="checkbox"/> Drained							
Modified <input type="checkbox"/>	Optimum _____ %			Height _____ Size _____ <input type="checkbox"/> Unconsolidated <input checked="" type="checkbox"/> Undrained							
Curve No. _____ of _____	Moisture _____ %			Diameter <u>1/2</u> " Material _____							
L.L. <u>30</u> P.L. <u>12</u> Class <u>CL</u> C_u <u>2.67</u>				<input checked="" type="checkbox"/> Undisturbed and Tested at: <input checked="" type="checkbox"/> Natural Moisture <input type="checkbox"/> Saturation							
% Finer Than: 0.002mm <u>20</u> 0.005mm <u>26</u> 200 <u>42</u>				<input type="checkbox"/> Remolded and Tested at: _____ % of <input type="checkbox"/> Standard <input type="checkbox"/> Modified							
Other Factors Affecting Shear:				with $w =$ _____ % which is							
% Dispersion <u>50</u> % Salt _____				<input type="checkbox"/> Lower than Optimum <input type="checkbox"/> Optimum <input type="checkbox"/> Higher than Optimum <input type="checkbox"/> Saturated							
Other: _____											
Test Data											
Before	After	Moisture Content			Lateral Pressure	Consolidation Data		Stress at Failure	% Strain at Failure	Internal Friction	Unit Cohesion
Dry Density γ_{dm} pcf	Moist. Dry γ_{dm} Den. cc	Start %	% Sat. Start	End %	σ_3	Orig. e_0	Final e_f	$\sigma_1 - \sigma_3$	f	ϕ Tan ϕ	
1.54		26.3	25.3	26.4	0	77.67		80	3	ϕ	
1.50	1.51	25.3	25.2	26.2	7	77.34	78.15	13.7	3	16°	30 psi
1.52	1.53	26.6	26.9	25.2	16	76.76	75.22	15.7	3		425 psf
1.49	1.50	25.9	26.6	25.8	21	82.54	72.34	24.7	5	Tan ϕ	

 $\sigma_1 - \sigma_3$ in Pounds per Square Inch

SCS-355 (Rev. 4/59)

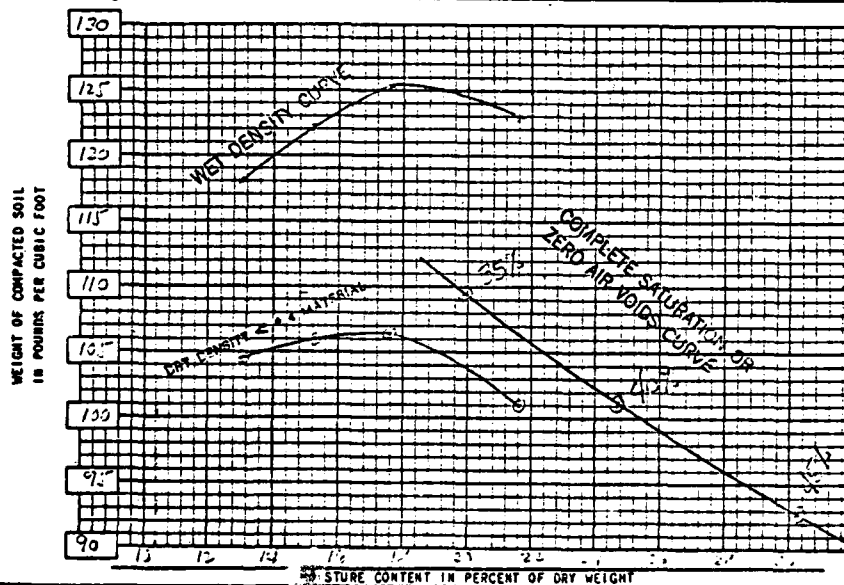
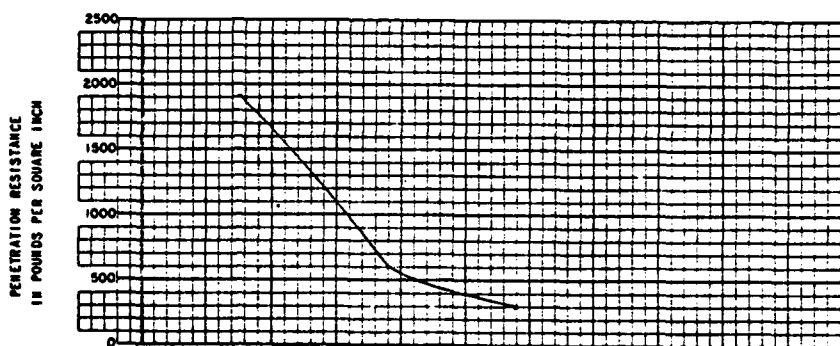
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICESOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATASample Number 63W3025Project Blackwater River #A-1Location Missouri

Moisture-Density Data				Specifications:							
Standard <input checked="" type="checkbox"/>	Max. γ	110.0 pcf		Specimen: Max.	<input checked="" type="checkbox"/> Consolidated	<input type="checkbox"/> Drained					
Modified <input type="checkbox"/>	Optimum			Height	<input type="checkbox"/> Unconsolidated	<input checked="" type="checkbox"/> Undrained					
Curve No. <u>2</u> of <u>2</u>	Moisture	16.0 %		Size <u>4</u>							
L.L. <u>36</u>	P.L. <u>17</u>	Class <u>CL</u>	G_s <u>2.67</u>	Diameter <u>1.5</u> "	Material						
% Finer Than: 0.002mm <u>2</u> 0.005mm <u>32</u> #20 <u>85</u>				<input type="checkbox"/> Undisturbed and Tested at: <input type="checkbox"/> Natural Moisture <input type="checkbox"/> Saturation <input checked="" type="checkbox"/> Remolded and Tested at: <u>25</u> % of <input checked="" type="checkbox"/> Standard <input type="checkbox"/> Modified with $w =$ _____ % which is <input type="checkbox"/> Lower than <input type="checkbox"/> Optimum <input type="checkbox"/> Higher than <input checked="" type="checkbox"/> Saturated Optimum							
Other Factors Affecting Shear: % Dispersion <u>41</u> % Salt _____ Other: _____											
Test Data											
Dry Density γ pcf	% Max. Dry Den.	Moisture Content			Lateral Pressure σ_3	Consolidation Data		Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ϵ	Internal Friction ϕ Tan ϕ	Unit Cohesion psi
		Start %	% Sat. Start	End %		Orig. e_0	Final e_f				
103.0	93.6	21.7	92.7	21.7	7	1.303	1.303	20.5	14	ϕ	5.2 psi 750 psf
123.6	94.2	22.3	94.5	21.8	10	1.205	1.202	23.1	2.5	17.5°	
103.0	93.6	21.6	92.3	21.4	14	1.302	1.208	26.3	2.7		
102.3	93.0	22.1	92.9	21.3	21	1.402	1.208	30.4	14.1	Tan ϕ	

 $\sigma_1 - \sigma_3$ in Pounds per Square Inch

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 101-1 Lab 63W 3824
 Project: SO. PARK OF ROCKWATER Location MISSOURI
 Sample Location and Depth EASTON 3+00 (1+5) DEPTH 1-7'



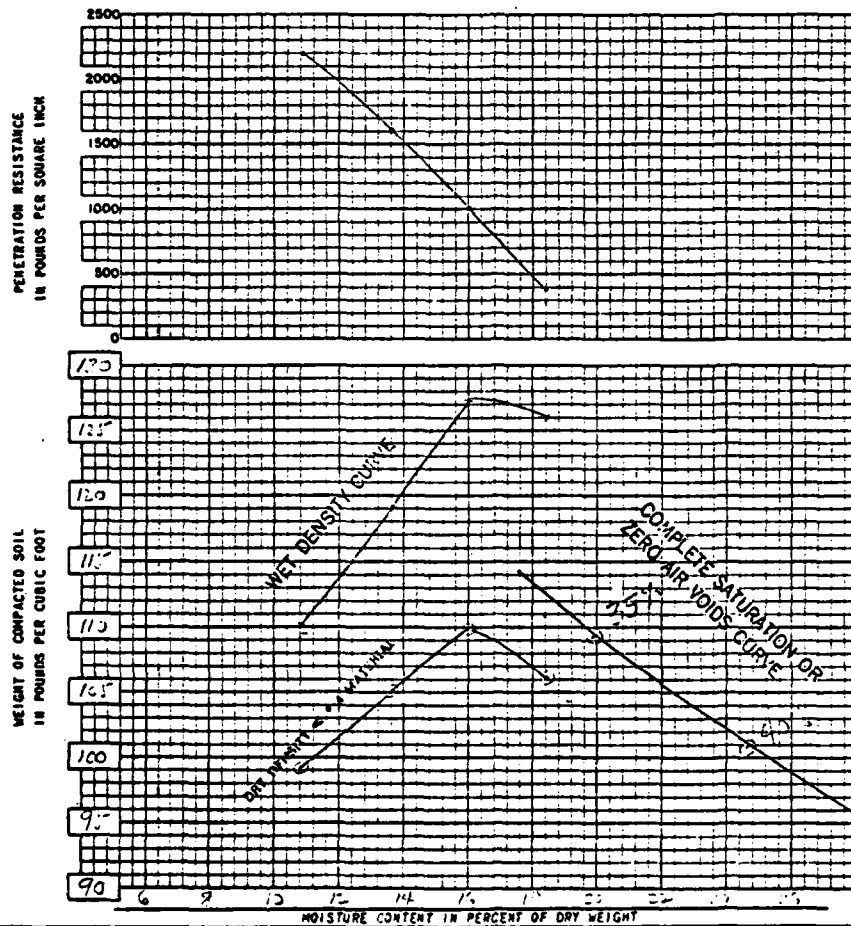
TYPE OF TEST <input checked="" type="checkbox"/> Standard Proctor <input type="checkbox"/> Modified AASHTO <input type="checkbox"/> Other _____	TEST PROCEDURE Weight of Hammer <u>5.5</u> Lbs. Drop <u>12</u> inches Lifts <u>3</u> Vol. of Cylinder <u>1/20</u> Cu.Ft.	Classification <u>CL</u> Material compacted represents <u>100</u> percent of the sample and passed <u>#4</u> sieve (Sp. Gr.) G_s <u>2.71</u> Curve <u>1</u> of 2
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SCS-352 Rev. (10/58)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field _____ Lab 63W378E
 Project SO. FORK OF RIVERWATER Location MISSOURI
 Sample Location and Depth * COMPOSITE



TYPE OF TEST <input checked="" type="checkbox"/> Standard Proctor <input type="checkbox"/> Modified AASHTO <input type="checkbox"/> Other _____	TEST PROCEDURE Weight of Hammer <u>5.5</u> Lbs. Drop <u>12</u> Inches Lifts <u>3</u> Vol. of Cylinder <u>1/30</u> Cu. Ft.	Classification <u>CL</u> Material compacted represents <u>100</u> percent of the sample and passed <u>14</u> sieve (Sp. Gr.) $G_s =$ <u>2.69</u> Curve <u>2 of 2</u>
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SHEET 1 of 1

FORM 353-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State MISSOURI Project SA F. D. ... - Site 2-1

Date 7-18-62 Analysis Made By G. L. H. Checked By G. L. H.

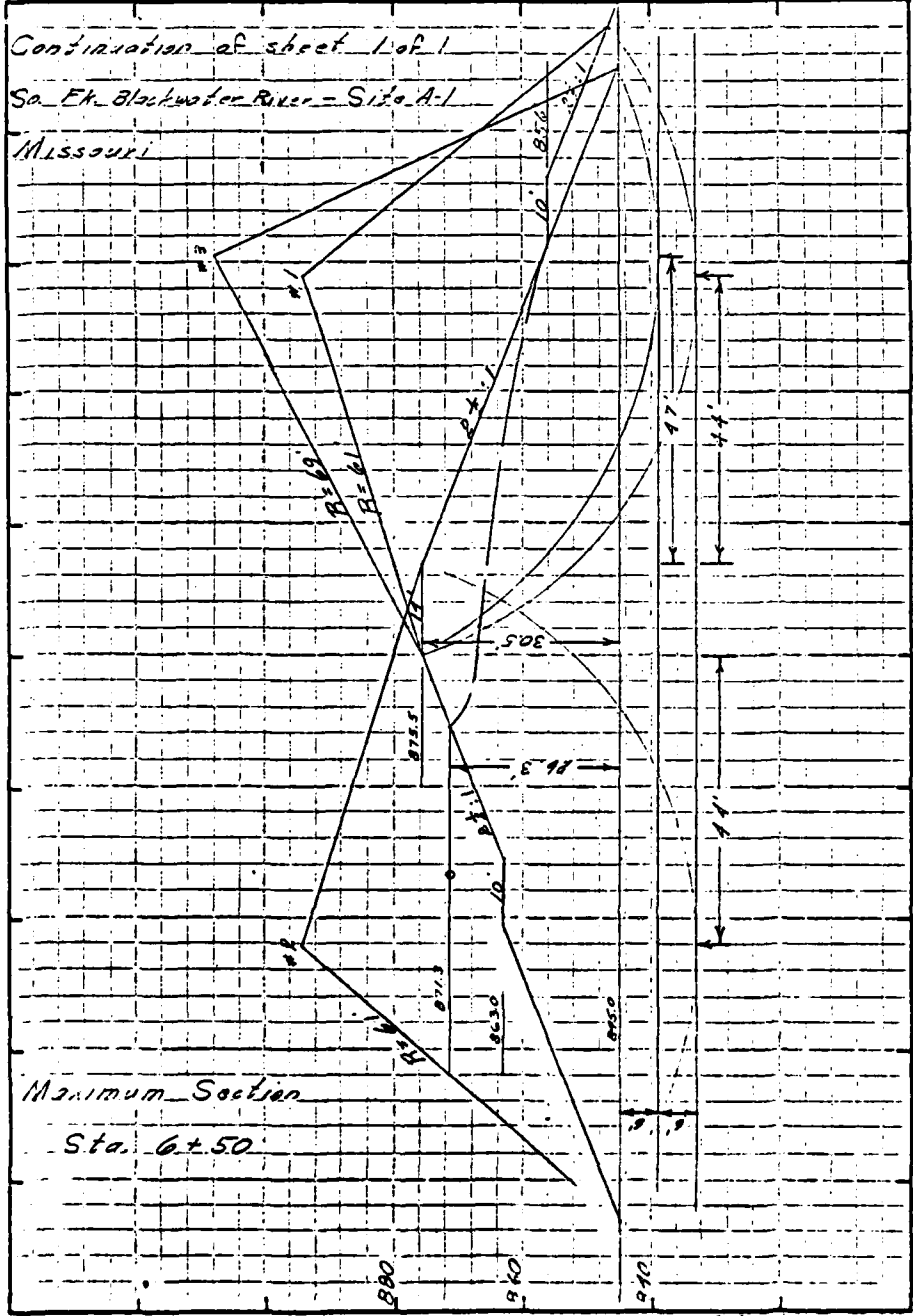
Method of Analysis SWEDISH CIRCLE

Location of Material	From	From					From				
	CL	CL					5% CL				
Sample No.	42W/297A	Guida					42W/295E				
γ_d	94.5	92.0					103.0				
γ_m							10.5				
γ_s	119.0	110.0					125.5				
γ_b	54.5	54.5					10.0				
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	
ϕ	9°	15°		10°				17.5°			
$\tan \phi$	-	0.257		0.176				0.316			
c	575	425		300				200			

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
2	2 1/2:1	Full drawdown; 10' from crest; Arc cut from top shoulder into embankment; 43W/295E & 10' long *found sand; γ_s values used.	1.50
2A	2 1/2:1	Unconsolidated Foundation Strength (C=575) Moist Embankment - Represents a Condition Immediately After Construction	1.27
		*found zoning: 0'-6' of 43W/317A; 6'-12' of 43W/317A; C=300	

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
1	2 1/2:1	No drawdown; Arc cut from top shoulder into embankment; 43W/295E & 10' long *found sand; γ_s values used.	1.22
1A	2 1/2:1	Same as #1 except 10' from crest	1.36
3	2 1/2:1	Unconsolidated Sand layer - placed and weighted into embankment after construction (Shallow Arc)	1.71

Continuation of sheet 1 of 1
 Sta. Elk Blackwater River - Site A-1
 Missouri



APPENDIX C
HYDROLOGIC AND HYDRAULIC DESIGN DATA

STRUCTURE DATA

Class of Structure "Q" Floodwater Retarding
 Drainage Area (total) 29.54 Ac. 4.459 Sq. Mi.
 (uncontrolled) 16.75 Ac. 2.617 Sq. Mi.
 Time of Concentration 2.71 Hours
 Soil Cover Complex Number 73 For A.M.C. II
 Sediment Capacity Available 85.0 Ac. Ft. below Elev. 863.0
 Total Sediment Capacity Available 85.0 Ac. Ft.
 Capacity Equivalents (Vol.) 0.61 In.
 Retarding Capacity Provided 3400 Ac. Ft.
 Capacity Equivalents (Vol.) 2.44 In.
 Water Supply Provided NONE Ac. Ft. - Identify Uses

Principal Spillway:

Maximum Capacity (low-stage) 2310 c.f.s.
 Maximum Capacity (high-stage) _____ c.f.s.
 10 Day Drawdown Elev. 863.0
 Emergency Spillway:
 Percent Chance Use 4 Storm Duration 6 Hours
 Type Vegetation Factor Value Used 0.04
 Emergency Spillway Hydrograph for Class "Q" Structures

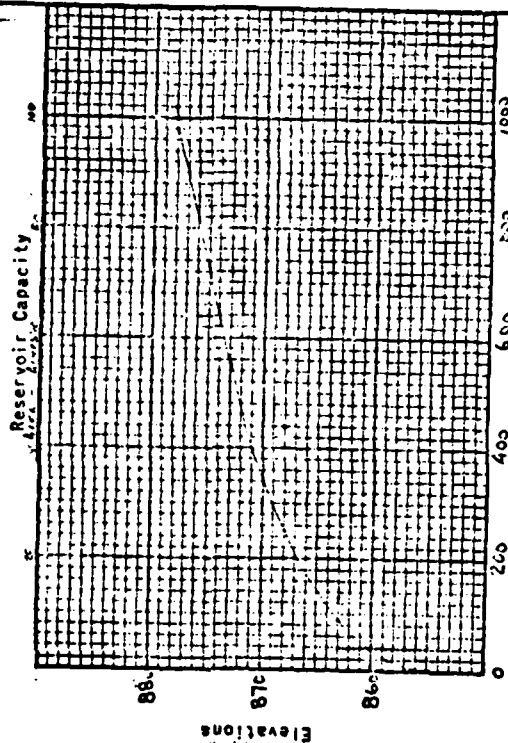
Rainfall 5.69 in.
 Runoff 2.85 in.
 Peak Inflow 2485 c.f.s.
 Maximum Discharge - Emergency Spillway 220 c.f.s.
 Maximum Water Surface Elev. 871.72
 Velocity of Flow (V) 3.7 f.p.s.

Supplementary Data and Special Design Features:

Principal Spillway Crest Elev. = 863.0
 Emergency Spillway Crest Elev. = 871.3
 Emergency Spillway Bottom Width = 150'
 Settled Top of Dam Elev = 874.3
 H X S = 26.2 X 425

Freeboard Hydrograph for Class "Q" Structures

Rainfall 5.21 in.
 Runoff 5.13 in.
 Peak Inflow 4839 c.f.s.
 Maximum Discharge - Emergency Spillway 1909 c.f.s.
 Maximum Water Surface Elev. 873.7



Total Storage - Ac. Ft.

Supplementary Data and Special Design Features:

STRUCTURE A-1	
Blackwater River Watershed PL-546	
Johnson County, Missouri	
U.S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Designed by	Checked by
Drew JAC	12/7
Date	12/7

STRUCTURE DATA

Class of Structure "a" Grade Stabilization
 Drainage Area (total) 824 Ac. 1.288 Sq. Mi.
 (uncontrolled) 824 Ac. 1.288 Sq. Mi.
 Time of Concentration 0.72 Hours
 Soil Cover Complex Number 74 For A.M.C. II
 Sediment Capacity Available 75.8 Ac. Ft. below Elev. 944.0
 Total Sediment Capacity Available 75.8 Ac. Ft.
 Capacity Equivalents (Vol.) 1.10 In.
 Retarding Capacity Provided 102.0 Ac. Ft.
 Capacity Equivalents (Vol.) 1.48 In.
 Water Supply Provided None Ac. Ft. - Identify Uses

Principal Spillway:

Maximum Capacity (low-stage) 173 c.f.s.
 Maximum Capacity (high-stage) 944.0 c.f.s.
 10 Day Drawdown Elev. 944.0

Emergency Spillway:

Percent Chance Use 4 Storm Duration 6 Hours
 Type Vegetated Earth "n" Value Used 0.04
 Emergency Spillway Hydrograph for Class "a" Structures

Rainfall 5.75 in.
 Runoff 2.98 in.
 Peak Inflow 1221 c.f.s.
 Maximum Discharge - Emergency Spillway 147 c.f.s.
 Maximum Water Surface Elev. 950.7
 Velocity of Flow (V_e) 5.1 f.p.s.

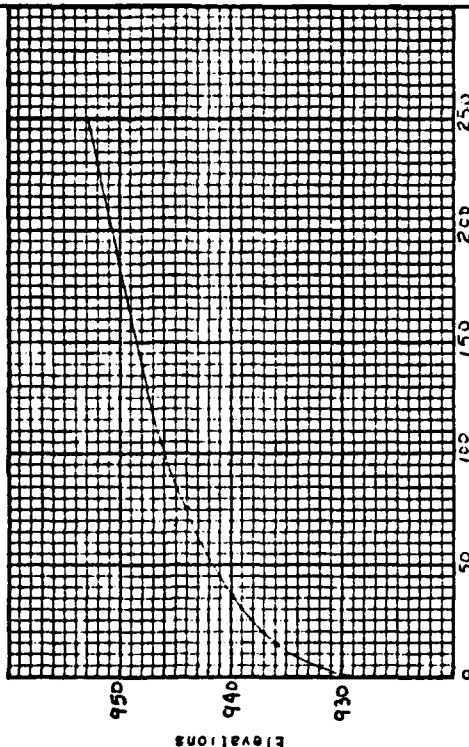
Supplementary Data and Special Design Features:

Principal Spillway Crest Elev. 944.0
 Emergency Spillway Crest Elev. 949.8
 Emergency Spillway Bottom Width. 85'
 Settled Top of Dam Elev. 952.3
 HXS = 26.5 x 177.8 = 4,712

Freeboard Hydrograph for Class "a" Structures

Rainfall 8.29 in.
 Runoff 5.19 in.
 Peak Inflow 2394 c.f.s.
 Maximum Discharge - Emergency Spillway 967 c.f.s.
 Maximum Water Surface Elev. 952.3

Reservoir Capacity



Total Storage - Ac. Ft.

Supplementary Data and Special Design Features:

STRUCTURE A-20	
Blackwater River Watershed PL-560	
Johnson County, Missouri	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Project <u>TAC</u>	Drawn by <u>12-71</u>
Sheet <u>2-ES</u>	Date <u>12-71</u>

STRUCTURE DATA

Class of Structure "a" Grade Stabilization
 Drainage Area (total) 1179 Ac. 1843 Sq. Mi.
 (uncontrolled) 255 Ac. 0.555 Sq. Mi.
 Time of Concentration 0.32 Hours
 Soil Cover Complex Number 74 For A.M.C. II
 Sediment Capacity Available 52.8 Ac. Ft. below Elev. 914.0
 Total Sediment Capacity Available 52.8 Ac. Ft.
 Capacity Equivalents (Vol.) 4.79 In.
 Retarding Capacity Provided 164.0 Ac. Ft.
 Capacity Equivalents (Vol.) 5.55 In.
 Water Supply Provided None Ac. Ft. - Identify Uses

Principal Spillway:

Maximum Capacity (low-stage) 119 c.f.s.
 Maximum Capacity (high-stage) _____ c.f.s.
 10 Day Drawdown Elev. 914.0

Emergency Spillway:

Percent Chance Use A Storm Duration 6 Hour
 Type Age-Total Earth "n" Value Used 0.04
 Emergency Spillway Hydrograph for Class "a" Structures

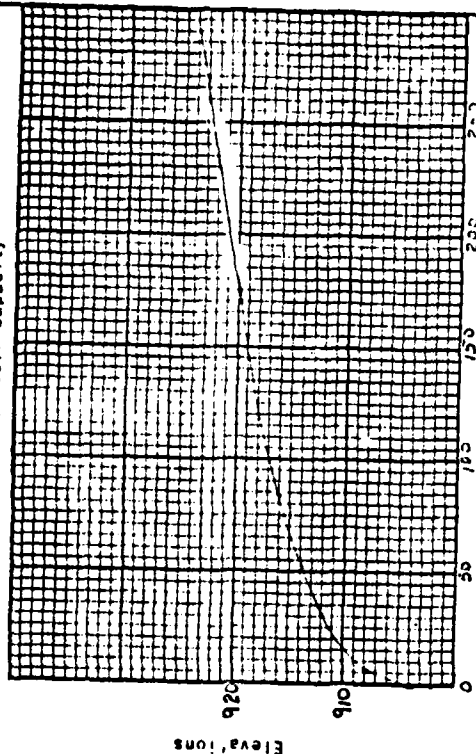
Rainfall 5.75 in.
 Runoff 3.04 in.
 Peak Inflow 793 c.f.s.
 Maximum Discharge - Emergency Spillway 41 c.f.s.
 Maximum Water Surface Elev. 921.1
 Velocity of Flow (Vel) 2.9 f.p.s.

Supplementary Data and Special Design Features:

Principal Spillway Crest Elev = 914.0
 Emergency Spillway Crest Elev = 921.5
 Emergency Spillway Bottom Width = 100'
 Settled Top of Dam Elev. = 923.7
 HXS 21.7 x 216.8

Freeboard Hydrograph for Class "a" Structures
 Rainfall 8.29 in.
 Runoff 5.28 in.
 Peak Inflow 4621 c.f.s.
 Maximum Discharge - Emergency Spillway 723 c.f.s.
 Maximum Water Surface Elev. 923.63

Reservoir Capacity



Total Storage - Ac. Ft.

Supplementary Data and Special Design Features:

STRUCTURE A-21

Blackwater River Watershed PL-506
 Johnson County, Missouri
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Project	State	County	Section
From	24C	12-71	
Sheet			
Checked	E.S.	12-71	

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DATE
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